CLAIMS

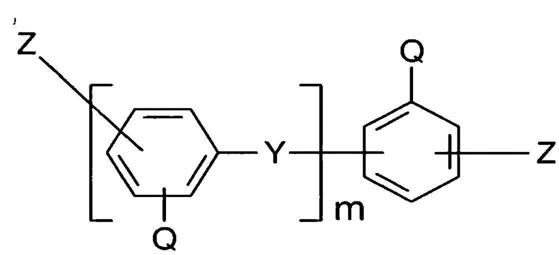
1. A block copolymer for use as a solid polymer electrolyte, said block copolymer having at least first and second segments, the first segments being provided with acidic substituents for proton transport and the second segments having substantially no acidic substituents and serving for the mechanical integrity of the solid polymer electrolyte.

2. A block copolymer in accordance with claim 1, wherein said first segments are hydrophilic segments and said second segments are hydrophobic segments.

3. An ion-conductive membrane made from a block copolymer in accordance with claim 1.

4. An ion-conductive membrane made from a block copolymer in accordance with claim 2.

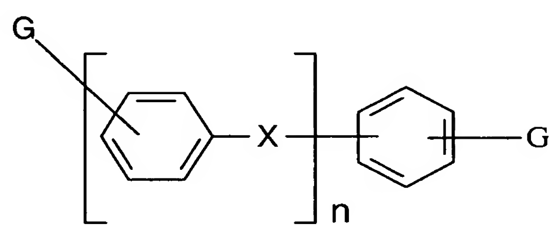
5. An ion-conductive membrane in accordance with claim 3, wherein said first segments have the general formula



in which:

Y represents $-O-$, $-S-$, $-CO-$, $-SO_2-$, $-C(CH_3)_2-$, or $-C(CF_3)_2-$, diphenyl methylene, diphenyl silicon, fluorenyl or a bond directly to the next aromatic ring,
end groups Z represent a halogen (F, Cl, Br, I), $-NO_2$ or $-OH$,
Q represents $-SO_3H$, $-SO_3^-M^+$, $-COOH$, $-COO^-M^+$, $-PO_3H_2$, $-PO_3H^-M^+$, or $-PO_3^{2-}2M^+$ where M is a metal such as Na or K,
with m being preferably between 5 and 200,
with the bridges Y between sequential aromatic rings when m > 1 being the same or different and being selected from any of the above atoms or groups listed for Y, and
with Q not having to be present in every aromatic ring.

6. An ion-conductive membrane in accordance with claim 3, wherein said second segments have the general formula

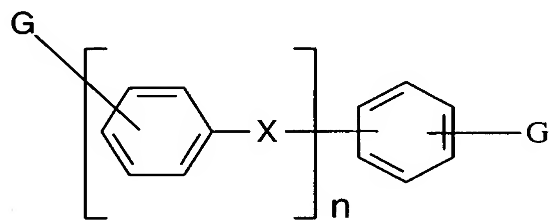


in which:

X represents $-O-$, $-S-$, $-CO-$, $-SO_2-$, $-C(CH_3)_2-$, $-C(CF_3)_2-$, diphenyl methylene, diphenyl silicon, fluorenyl or a bond directly to the next aromatic ring,
the end groups G represent a halogen (F, Cl, Br, I), $-NO_2$ or $-OH$,

with the number of repeating units n of an aromatic ring constituting a second segment forming a hydrophobic block preferably lying in the range from 5 to 200, and
with the bridges X between sequential aromatic rings being the same or different and being selected from any of the above atoms or groups listed for X.

7. An ion-conductive membrane in accordance with claim 5, wherein said second segments have the general formula



in which:

X represents $-O-$, $-S-$, $-CO-$, $-SO_2-$, $-C(CH_3)_2-$, $-C(CF_3)_2-$, diphenyl methylene, diphenyl silicon, fluorenyl or a bond directly to the next aromatic ring,
the end groups G represent a halogen (F, Cl, Br, I), $-NO_2$ or $-OH$,
with the number of repeating units n of an aromatic ring constituting a second segment forming a hydrophobic block preferably lying in the range from 5 to 200, and
with the bridges X between sequential aromatic rings being the same or different and being selected from any of the above atoms or groups listed for X.

8. An ion-conductive membrane in accordance with claim 5, wherein at least one additional segment is present of the same general composition as the aforesaid first segments, but with different atoms

or groups Y or Q and with the atoms or groups Y being in any desired rational sequence.

9. An ion-conductive membrane in accordance with claims 6, wherein at least one additional segment is present of the same general composition as the aforesaid second segments, but with different atoms or groups X and with the atoms or groups X being in any desired rational sequence.

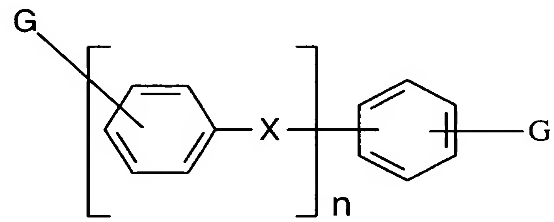
10. An ion-conductive membrane in accordance with claim 6 and having a micro-phase separated morphology, for example in the form of spheres, cylinders or lamellae, or of ordered bi-continuous double diamond structures.

11. An ion-conductive membrane in accordance with claim 6 in which the second segments have a molar mass from 5×10^2 to 5×10^5 (g/mol).

12. An ion-conductive membrane in accordance with claim 3, wherein said second segments are hydrophobic blocks substantially consisting of a main chain of aromatic rings or aromatic rings and bridging groups having no sulfonic acid groups in said main chain.

13. A method of manufacturing a block copolymer for use as a solid polymer electrolyte, said block copolymer having at least first and second segments, the first segments being provided with acidic substituents for proton transport and the second segments having substantially no acidic substituents and serving for the mechanical integrity of the solid polymer electrolyte, the method comprising the steps of:

a) synthesizing an end functionalised oligomer (block) consisting of a plurality of said second segments, said second segments having the general formula



in which:

X represents $-O-$, $-S-$, $-CO-$, $-SO_2-$, $-C(CH_3)_2-$, $-C(CF_3)_2-$, diphenyl methylene, diphenyl silicon, fluorenyl or a bond directly to the next aromatic ring and

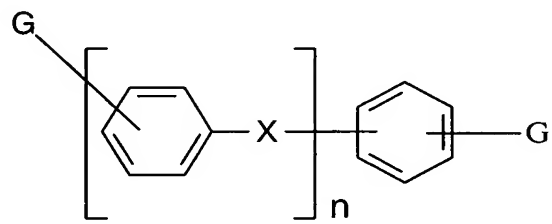
the end groups G represent a halogen (F, Cl, Br, I), NO_2 or $-OH$,

with the number of repeating units n of an aromatic ring constituting a second segment forming a hydrophobic block preferably lying in the range from 5 to 200 and with the bridges X between sequential aromatic rings being the same or different and being selected from any of the above atoms or groups listed for X, and

b) synthesis of a block copolymer by reacting the product of step a) with a monomer, or a mixture of monomers, suitable for forming said first segments, said monomer or monomers being selected from the group consisting of bisphenols, aromatic difluorides, aromatic dichlorides, aromatic dibromides, aromatic diiodides, and aromatic dinitro compounds, and any desired combinations thereof, said members of said group having an acid substituent at least some of the phenyl rings.

14. A method of manufacturing a block copolymer for use as a solid polymer electrolyte, said block copolymer having at least first and second segments, the first segments being provided with acidic substituents for proton transport and the second segments having substantially no acidic substituents and serving for the mechanical integrity of the solid polymer electrolyte, the method comprising the steps of:

a) synthesizing an end functionalised oligomer (block) consisting of a plurality of said second segments, said second segments having the general formula

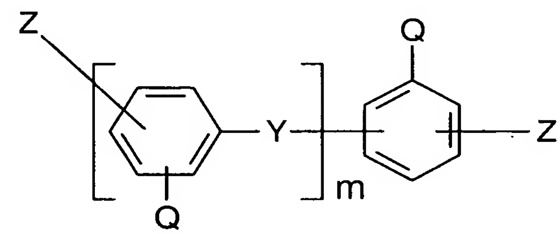


in which:

X represents $-O-$, $-S-$, $-CO-$, $-SO_2-$, $-C(CH_3)_2-$, $-C(CF_3)_2-$, diphenyl methylene, diphenyl silicon, fluorenyl or a bond directly to the next aromatic ring and
the end groups G represent a halogen (F, Cl, Br, I), NO_2 or $-OH$,
with the number of repeating units n of an aromatic ring constituting a second segment forming a hydrophobic block preferably lying in the range from 5 to 200 and
with the bridges X between sequential aromatic rings being the same or

different and being selected from any of the above atoms or groups listed for X,

b) synthesising an end-functionalised oligomer (block) consisting of a plurality of first segments having the general formula



in which:

Y represents $-O-$, $-S-$, $-CO-$, $-SO_2-$, $-C(CH_3)_2-$, or $-C(CF_3)_2-$, diphenyl methylene, diphenyl silicon, fluorenyl or a bond directly to the next aromatic ring,

the end groups Z represent a halogen (F, Cl; Br, I), $-NO_2$ or $-OH$, Q represents $-SO_3H$, $-SO_3^-M^+$, $-COOH$, $-COO^-M^+$, $-PO_3H_2$, $-PO_3H^-M^+$, or $-PO_3^{2-}2M^+$ where M is a metal such as Na or K,

with m being preferably between 5 and 200,

with the bridges Y between sequential aromatic rings when m > 1 being the same or different and being selected from any of the above atoms or groups listed for Y,

with Q not having to be present in every aromatic ring and with G and Z being selected as partners capable of a coupling reaction, and

c) reacting the products of steps a) and b) to form the block copolymer.

15. A method of preparing an ion-conductive membrane from a block copolymer made in accordance with the method of claim 13, the method comprising the steps of:

a) transforming the acid groups of the block copolymer to acid halide groups,

b) casting a film from a solution of the acid halide form of the block copolymer of step a) onto a substrate and

c) transforming the acid halide groups into the corresponding acid groups, whereby said membrane is formed.

16. A method in accordance with claim 15, wherein acid groups present in the block copolymer are in the form of a salt.

17. A method in accordance with claim 15, wherein the acid groups present in the block copolymer are present in their acid form.

18. A method in accordance with claim 15, wherein the transformation into the acid halide form is a transformation into an acid chloride form and is effected by the use of thionyl chloride, phosphoryl chloride or oxalyl chloride.

19. A method in accordance with claim 15, wherein the transformation into the acid halide is a transformation into an acid chloride form and is effected using thionyl chloride as a solvent.

20. A method of preparing an ion-conductive membrane from a block copolymer made in accordance with the method of claim 14, the method comprising the steps of:

a) transforming the acid groups of the block copolymer to acid halide groups,

b) casting a film from a solution of the acid halide form of the block copolymer of step a) onto a substrate and

c) transforming the acid halide groups into the corresponding acid groups, whereby said membrane is formed.

21. A method in accordance with claim 20, wherein acid groups present in the block copolymer are in the form of a salt.

22. A method in accordance with claim 20, wherein the acid groups present in the block copolymer are present in their acid form.

23. A method in accordance with claim 20, wherein the transformation into the acid halide form is a transformation into an acid chloride form and is effected by the use of thionyl chloride, phosphoryl chloride or oxalyl chloride.

24. A method in accordance with claim 20, wherein the transformation into the acid halide is a transformation into an acid chloride form and is effected using thionyl chloride as a solvent.